May 2, 1933. A. G. SCHURICHT 1,907,218

AMMUNITION CASE

Filed Jan. 28, 1931

Fig. 1.

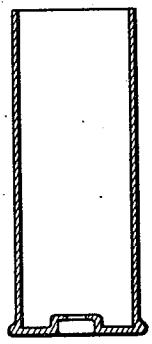

Fig. 2.

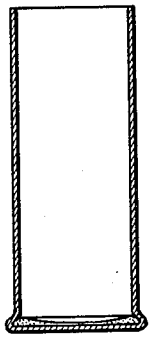

Fig. 3.

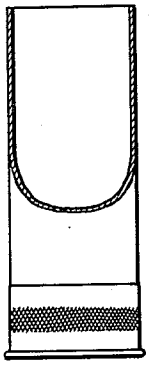

Fig. 5.

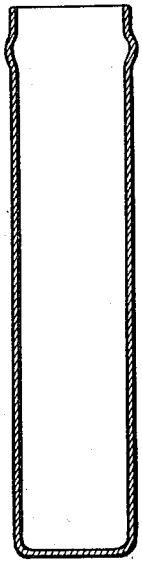

Fig. 4.

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UNITED STATES PATENT OFFICE

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AMMUNITION CASE

Application filed January 28, 1931. Serial No. 511,880.

This invention relates generally to ammunition, and particularly to containers as are adapted for cartridge cases, primer cups and other analogous use in ammunition.

A rifle cartridge is composed of a shell having a primer, a projectile, and a projectile-propelling or propellant charge. In a rifle cartridge of small calibre and which is usually of the rim-fire type, the priming composition is located in an annular recess at the rim, while in a cartridge of the center-fire type, this priming composition is provided in a cap at the center of the base. Since the cartridge must be extracted, particularly after firing, an extracting element engages under the rim of the shell and while this element forms a continuation of the bore at the breech, there results a zone in the region of the extractor where the shell is not as efficiently supported as at other parts around the circumference just forward of the rim. It follows, therefore, that any alteration of the powder charge which tends to produce increased chamber pressures is liable to distort, and even rupture the shell, particularly in the region of the extractor. This is particularly true of rim-fire cartridges. In such a cartridge the formation of the annular primer recess at the rim by an upsetting operation requires that the metal wall of the shell at the base be sufficiently thin to permit such recess to be properly formed. Accordingly, the strength of the shell of a rim-fire cartridge, particularly one of small calibre, is limited, so that the permissible pressure which such a shell will withstand without distortion and even rupturing is likewise limited. It is thus apparent that any effort to increase the velocity of the projectile is unsuccessful until cartridge cases of greater strength than heretofore are provided.

Rim-fire cartridge cases, more particularly those of small calibre, have heretofore generally been made from either pure copper or from an alloy of copper and zinc, and most usually an alloy known as "gilding" metal, containing approximately 95% of a copper and 5% of zinc, has been used. While 22 calibre cartridge of such an alloy has been found to be adapted to withstand pressures of approximately sixteen thousand pounds per square inch, with the introduction of supercharges of powder, and particularly of a fast-burning powder, peak pressures considerably in excess of sixteen thousand pounds per square inch occur. Consequently, cartridge cases made in accordance with the alloys of the prior art have not been capable of withstanding such pressures and in the attempted use thereof, the heads of the cartridges have been found to swell excessively and in some instances to burst and blow off completely. It is not possible to increase the thickness of the metal beyond a certain limit, as the metal must be upset to form the rim, and unless the thickness is kept down the required annular rim recess will not be properly formed.

From the standpoint of strength and toughness, it would appear that cartridge brass which is an alloy containing approximately 70% of copper and 30% of zinc, would be suitable for the formation of such cartridge cases as are to be employed with supercharges of a fast-burning powder. Such brass is, however, subject to so-called "season cracking" when exposed to moist atmospheric conditions, and especially in rim-fire cartridges of small calibre where the primer recess is formed by an upsetting operation and interior stresses are set up within the cartridge at this point so that such cartridge cases are particularly susceptible to season cracking at the flanges thereof. Furthermore, such cartridge brass is quickly attacked by the mercuric fulminate in the priming composition, such as heretofore employed, and although this condition may be avoided by the use of non-fulminate priming composi-

tion, the present knowledge of such non-fulminate priming compositions is too limited to permit the use thereof where dependable ballistic characteristics are required. Even though non-fulminate priming compositions were used, cartridges made of such brass would still be subject to season cracking. It is obvious that a cartridge case which has been subject to season or mercury cracking would not only seriously affect the ballistics of the ammunition, but would also operate as an extreme hazard to the marksman.

Center-fire cartridge cases are generally made of an alloy having a lower content of copper than the alloy employed for rim-fire cartridge cases and are subject to the same season cracking and mercury attack that is encountered by the cartridge cases of the rim-fire type. Likewise, primer cups are subject to such cracking. Heretofore, primer cups have been made either of "gilding metal", an alloy containing approximately 95% copper and the balance zinc, or of cartridge brass. Gilding metal, since it is not subject to the attack of mercury, is readily adaptable for use with a mercuric fulminate priming composition, but it does not possess sufficient tensile strength or ductility for the use to which it is put. Accordingly, primer cups are often apt to pierce, especially when used with heavy priming charges. Brass possesses the necessary strength and ductility, being superior to gilding metal in this respect but on the other hand, is subject to season cracking and mercury attack, both of which cause splitting and pierced caps. Season cracking of brass in primer cups in which the metal is not extremely worked, may be overcome to some extent by annealing but this annealing must be controlled within very restricted limits. The mercury attack upon primer cups has been to an extent overcome by plating the cups with such a metal as nickel, which is not subject to the mercury attack, but that is expensive and not entirely satisfactory.

In a shot shell, a paper tube is set into a metallic base provided with a battery cup, and in this tube is a base wad, the metallic base being interlocked with the tube and base wad. This metallic base must be of stability and therefore of a certain thickness to properly function, even though it is desirable that the thickness of the part enveloping the shell be small in order to form a smooth continuation of the tube. Here again the copper alloy heretofore used limits the minimum thickness while brass is again subject to cracking.

A blasting cap is composed of a metallic shell having a charge which again includes mercury fulminate. Here again difficulties are encountered in the use of both copper alloys and brass as heretofore used.

It is thus apparent that many features of disadvantage have been found in the use of such alloys, as have been heretofore known for use in the making of ammunition cases or containers, due to the peculiar conditions encountered in their loading and use.

One of the objects of this invention generally stated is to provide an ammunition case composed of an alloy peculiarly adaptable for use in the formation of such cases and which will overcome the disadvantageous features of those heretofore used.

A further object of this invention is to provide an alloy for the manufacture of ammunition cases, which is not subject to attack of mercury fulminate.

Another object of this invention is to provide an alloy for the manufacture of ammunition cases, which shall possess the necessary hardness, tensile strength and elasticity, and be immune to the action of both mercury fulminate and season cracking induced by moisture.

A more specific object of this invention is to provide a metallic ammunition case formed of an alloy containing silicon.

Further objects of this invention will become apparent to those skilled in the art when the following description is read in connection with the accompanying drawing, in which:

Figure 1 is a sectional view in side elevation of a cartridge case of the center-fire type;

Figure 2 is a sectional view in side elevation of a cartridge case of the rim-fire type;

Figure 3 is a sectional view of a shot shell;

Figure 4 is a sectional view of a primer cup; and

Figure 5 is a sectional view of a blasting cap shell.

In accordance with this invention the ammunition case is made of an alloy containing a predominating percentage of copper, supplemented by either zinc or tin and containing a small percentage of a suitable metal such as silicon, which has the property of influencing the properties of the alloy and rendering the same particularly suitable for employment in the making of ammunition cases. It has been found that the tensile strength will be substantially increased without sacrifice of elasticity, so that, for instance, cartridge cases formed from such an alloy are capable of withstanding the increased pressures developed by supercharges of powder and charges of fast-burning powder developing a high peak pressure. Furthermore, the addition of silicon to copper alloys, in which the copper content is reduced, will render the case immune to the action of mercury fulminate and moisture and prevent season cracking; this is true even if the percentages of zinc and copper are increased.

The silicon content of the alloy may vary from 0.5% to 4.5% depending upon the use to which the alloy is put in the ammunition field.

An alloy containing from 90–99.75% copper, from 4.5–.5% silicon and from 8.5–1% zinc or tin is particularly suitable for rim-fire shells, primer cups and blasting cap shells. An alloy in which the copper content is from 80–90% with the balance composed of varying proportions of silicon and zinc is also suitable for rim-fire shells, primer cups, blasting cap shells and also shot shell bases. An alloy containing from 60–80% copper with the balance composed of varying proportions of silicon and zinc is suitable for center-fire shells, shot shell bases and large calibre fixed ammunition.

As an illustrative embodiment of this invention, an alloy suitable for use in the formation of rim-fire cartridges cases will be described. An alloy for small calibre rim-fire cartridge cases preferably contains in excess of 90% copper, the balance being zinc and silicon in varying proportions, and sometimes tin. As an illustration of such an alloy is one containing from 93.75 to 95.25% of copper, having between 0.50% and 1% silicon and the balance zinc. Such an alloy possesses excellent physical characteristics having the desired elasticity, tensile strength, toughness and ductility, as well as being resistant to corrosion and the attack of mercury. Such an alloy is readily adaptable for rim-fire cartridge cases and primer cups. This alloy, however, is particularly adaptable for rim-fire cartridge cases, due to its high copper content. It is well known that in the formation of rim-fire cartridge cases, the severe working the metal in the formation of the recess for containing the priming composition sets up severe interior stresses which can only be withstood by an alloy having a high copper content. Moreover, this alloy permits the metal to be made sufficiently thin to permit formation of the rim and to provide the required recess for the primer composition. Other suitable alloys for this purpose are as follows.

Alloys containing between 80 and 90% of copper, the balance in varying proportions of zinc and silicon, have also been found adaptable for the same uses as the alloy just described. Although such alloys containing between 80 and 90% copper, have substantially the same characteristics, except for an increased ductility, this alloy may be readily used for the formation of shot shell bases. An alloy which is particularly suitable for shot shell bases is one containing 70% copper, 29.5% zinc and 0.5% silicon.

As heretofore pointed out, cartridge brass from which center-fire cartridge cases have heretofore usually been made, contains substantially 70% of copper, and it has been found that the addition of a small percentage of silicon to cartridge brass substantially improves the characteristics of the alloy and renders it more favorable for use as an ammunition case. Alloys containing between 65% and 80% of copper with small percentage of silicon and the balance zinc are satisfactory and readily adaptable for the formation of center-fire cartridge cases, shot shell heads and primer cups.

While silicon is particularly suitable as an improved constituent of an alloy containing a predominating percentage of copper, other metals may be employed and substituted in whole or in part and still attain some of the objects and advantages of this invention; among these may be mentioned phosphorus, iron, aluminum, magnesium, manganese and beryllium. It will, therefore, be understood that the term "silicon" is used descriptively to comprehend other metals having the properties and functions of silicon when alloyed with copper in the manufacture of ammunition cases. Silicon is, however, particularly suitable for ammunition cases when alloyed with a predominating percentage of copper with either zinc or tin.

Since it is apparent that the alloys of this invention are susceptible of various modified forms in proportion and ingredients without departing from the spirit of this invention, it is to be distinctly understood that the embodiments herein specifically described are merely illustrative and shall not be construed in a limiting sense. Furthermore, since it is possible that the alloys of this invention may be favorable in other fields of utility, it is to be distinctly understood that any such modifications and use of the alloys of this invention, which do not depart from the spirit thereof, are contemplated by and are within the scope of the appended claims. Thus these alloys may be employed for bullet jackets and driving bands for projectiles.

Having thus described the invention what is claimed is:

1. An ammunition case formed of a copper alloy containing 0.5–4.5% of silicon.

2. An ammunition case formed of an alloy containing more than 80% copper, less than 5% silicon, and another metal.

3. An ammunition case formed of an alloy containing 90–94.5% copper and 0.5–4.5% silicon.

4. An ammunition case formed of an alloy containing 90–94.5% copper, 1–9% zinc, and 0.5–4.5% silicon.

5. A rim-fire cartridge having a shell provided with a primer-receiving recess in its rim and formed of an alloy containing a predominating percentage of copper and 0.5—4.5% silicon.

6. A rim-fire cartridge having a shell provided with a primer-receiving recess in its rim and formed of an alloy containing over 80% of copper and 0.5–4.5% silicon.

7. A rim-fire cartridge having a shell provided with a primer-receiving recess in its

rim and formed of an alloy containing 90–94.5% copper and 0.5–4.5% silicon.

8. A rim-fire cartridge having a shell provided with a primer-receiving recess in its rim and formed of an alloy containing 90–94.5% copper, 1–9% zinc and 0.5–4.5% silicon.

9. A primer cup formed of an alloy containing 90–94.5% copper, 1–9% zinc and 0.5–4.5% silicon.

In testimony whereof I affix my signature this 24th day of November, 1930.

ALFONS G. SCHURICHT.